

[Translation]



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**[ABSTRACT OF THE DISCLOSURE]****[ABSTRACT]**

The present invention relates to a method for tracing reserved resources GTP (GPRS Tunnel Protocol) user message trafficked between SGSN (Serving GPRS Support Node) and GGSN (GPRS Gateway Serving Node). The present invention includes the steps of setting the tracing function for reserved resources of the subscriber message by using the TEID of the subscriber to be traced and outputting information for the corresponding resource by detecting the subscriber message with a set of the tracing function. The present invention effectively manages packet troubles generated from the SGSN by understanding of the GTP resource allotted to a corresponding GTP-U message that is the data of the subscriber and the attack of such EEOs through the GTP-U on Internet by isolating only the interface generating the corresponding attack. Further, the present invention may prevent declining of conducting capacity on a system by discontinuing the GTP-U tracing automatically through tracing function duration time and tracing critical value.

**[TYPICAL DRAWING]**

FIG. 7

[SPECIFICATION]

[TITLE OF THE INVENTION]

METHOD FOR TRACING GPRS TUNNEL PROTOCOL RESOURCE

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 illustrates a block diagram showing a related art GTP resource tracing system.

FIG. 2 illustrates a diagram showing a structure of related art tracing information DB according to the related art.

FIG. 3 illustrates a flow chart describing a related art GTP-C tracing function setting process.

FIG. 4 illustrates a flow chart describing a related art GTP-C tracing operation.

FIG. 5 illustrates a block diagram showing a GTP resource tracking system according to the present invention.

FIG. 6 illustrates a diagram showing a structure of the tracing information DB according to the present invention.

FIG. 7 illustrates a flow chart describing a GTP-U tracing operation according to the present invention.

FIG. 8 illustrates a flow chart of an operation of a call-tracing unit for setting GTP-U tracing function in FIG. 7.

FIG. 9 illustrates a flow chart of an operation of a call manager for setting GTP-U tracing function in FIG. 7.

FIG. 10 illustrates a flow chart for describing GTP-U tracing operation of a packet processor in FIG. 7.

FIG. 11 illustrates a flow chart for describing GTP resource information output operation of call-tracing part in FIG. 7.

**\*Reference numerals of the essential parts in the drawings\***

10 : SGSN	20 : GGSN(20)
21 : SGSN interface unit	22 : packet processor
23 : internet interface unit	
24 : call-tracing unit	
25 : tracing information DB	26 : call manager
30 : MMI	

**[DETAILED DESCRIPTION OF THE INVENTION]**

**[OBJECT OF THE INVENTION]**

**[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]**

The present invention relates to a method for tracing GTP (GPRS Tunnel Protocol) resource, and more particularly, to a method for managing an attack of DDOS (Distributed Denial of Service) from outside to GGSN or an error of a packet transmission of a particular subscriber by tracing allotted resources of a GTP user message trafficked between SGSN (Serving GPRS Support Node) and GGSN (GPRS Gateway Serving Node).

In general, the SGSN which is a GPRS serving node providing packet service to a mobile terminal is connected to

the GGSN through the GPRS back bone network based on IP. The GGSN directly connected to an external packet data network (Internet) for performing tunneling and routing functions. As illustrated in FIG. 2, the GGSN includes a SGSN interface unit (21), a packet processor (22), an internet interface unit (23), and a call manager (26).

The call manager (26) generates a tunnel between the SGSN (10) and the SGSN interface unit (21) by using GTP-C (GTP Control Message) by operating together with the packet processor (22) and the SGSN (10) when call of a user is required to be set. The GTP-U (GTP User Message) is trafficked through the generated tunnel.

Furthermore, the GGSN (20) includes a call-tracing unit (24) for tracing a corresponding GTP-C and reports the resource information (hereinafter abbreviated GTP resource information) reserved by a corresponding message to the operator when a call tracing request signal for a particular subscriber is received from the operator through the MMI (Man Machine Interface) (30) and a DB (25) for storing information of a call tracing in progress.

Upon receiving the call tracing request signal from the operator, the call-tracing unit (24) sets a GTP-C tracing function by storing an identification information (hereinafter 'tracing information') of a tracing object subscriber included in the corresponding message into the tracing information DB

(25), and reports the GTP resource information to the operator through the MMI (30) when the GTP resource information is received from the call processor (26).

The tracing information is stored by the call-tracing unit (24). Referring to FIG. 2, the tracing information DB (25) searched in the call-manager (26) when tracing GTP-C includes a INDEX field of the stored tracing information, an IMSI field (International Mobile Subscriber Identifier), a IMSI\_CNT field indicating the decimal point of the corresponding subscriber, an IP\_ADDR field for storing an IP (Internet Protocol) address of the corresponding subscriber, and a TRC\_TYPE field for indicating the corresponding tracing type.

The detailed structure of the TRC\_TYPE field is shown below.

**[Table 1]**

bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1
Priority	Reserved	BSS Record Type	SGSN Record Type		Invoking Event		

Referring to Table 1, in connection with GTP-C tracing, '1' is set for indicating that the developer can use the bit 3 to bit 7 arbitrarily to each Invoking Event bit which is a call tracing generation event as specified in GSM12.08.

Then, the SGSN Record Type bit is set to 0, 1 if the

corresponding tracing type is call-detecting, and set to 0 if the corresponding tracing type is call-tracing, and set to 1, 1 is call-tracing cancellation. The call-detecting outputs call time and location information of the subscriber of the corresponding call after the call of tracing object subscriber is completed. The call detecting outputs the corresponding message as the GTP-C is received.

The present invention will be described with reference to the attached drawing showing GTP-C tracing operation in GGSN (20).

FIG. 3 illustrates a flow chart describing a related art GTP-C tracing function setting process of the call-tracing unit (24). Referring to FIG. 3, the call-tracing unit (24) receives GTP-C tracing request message of an operator through MMI (30) (S301). The GTP-C tracing request message includes tracing information about IMSI of tracing object subscriber or IP address and tracing type.

The call-tracing unit received the corresponding GTP-C tracing request message analyzes the received message and stores the tracing information in the corresponding message in the tracing information DB (25). And then, when the tracing information is successfully stored in the tracing information DB (25) and the setting is completed, the call-tracing unit (24) outputs GTP-C tracing function setting success message to the operator (S303, S304), and outputs GTP-C tracing function

setting failure message when the information storage is failed (S303, S305).

FIG. 4 illustrates a flow chart describing a GTP-C tracing operation for a subscriber in which GTP-C tracing function is set as above.

Referring to FIG. 4, the call manager (26) receiving GTP-C from SGSN (10) through the packet processor (22) determines whether resource of the packet processor (22) and an internet interface unit (23) is available or not and performs other call managing processes, and transmits the corresponding result to the subscriber.

In this instance, the call manager (26) confirms whether the GTP-C tracing function is set or not for the corresponding subscriber by searching the tracing information DB (25).

As a result of the confirmation, if the corresponding function is set (S403), a tracing type of the tracing information DB (25) is confirmed. If the corresponding tracing type is a call-tracing type, the received GTP-C is transmitted to the call-tracing unit (24) (S404, S405) and if the corresponding tracing type is call-detecting unit, the call end time and location information of the subscriber are transmitted to the call-tracing unit (24) after the corresponding call is released (S404, S406).

Herein, the call-tracing unit (24) reports a state of



call currently progressed to the operator when receiving the GTP-C (S407) and reports the call end time and location information of the subscriber received when the corresponding call is released (S408).

As described above, since call tracing is carried out only for the GTP-C, tracing for the GTP-U that is current user data is not carried out from the reserved resource in the exchanger.

When trouble occurs in a packet transmitted from the SGSN, it is difficult for an operator of the exchanger to troubleshoot the underlying problem because it is difficult to exactly determine which interface unit is having the trouble.

Furthermore, in a case of the GTP-U trafficked from the Internet, when the corresponding message is under an attack of DDOS, the interface being attacked is not identified. Therefore, fast troubleshooting is not possible and there is a serious problem of damaging security and reliability of the exchanger.

#### **[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]**

An object of the present invention is to acknowledge the GTP resource allotted to a GTP-U by tracing the GTP-U of a real subscriber using TEID of the subscriber to be traced.

#### **[SYSTEM AND OPERATION OF THE INVENTION]**

To achieve these and other object and advantages, a method for tracing GTP resource according to the present invention includes the steps of setting the tracing function for reserved resources of the subscriber message by using the TEID of the subscriber to be traced and outputting information for the corresponding resource by detecting the subscriber message with a set of the tracing function.

Preferably, the step of setting the tracing function includes the steps of: transmitting the user tracing information received from the operator in the call tracing unit to the call manager; searching TEID allotted to the user using the tracing information in the call manager; registering the user message tracing function to the packet processor and transmitting the TEID to the call tracing unit; and storing the TEID together with the tracing information in the tracing information DB.

Preferably, the tracing information includes the IMSI and IP address of the subscriber, a tracing type for commanding the subscriber message tracing, and a trace critical value, i.e., a maximum number of the message of the subscriber to be traced. The tracing information, TEID and the trace count value that is the number of traced message are stored in the tracing information DB.

Preferably, the TEID registering step includes the steps of: receiving the TEID and the tracing information in

the packet processor; and activating the tracing flag of the corresponding TEID field in an inner TEID table and storing the tracing information.

The step of outputting the reserved resource information includes the steps of: confirming the TEID of the trafficked subscriber message in the packet processor; confirming whether the tracing flag of the confirmed TEID is activated by searching the TEID table; transmitting the reserved resource information of the subscriber together with the TEID to the call tracing unit when the tracing flag is activated; and outputting the reserved resource information to the operator by using the TEID from the call tracing unit.

The reserved resource information includes an AMA number of trafficked subscriber message, an interface number, a VPI/VCI, a link band, a value directing a stream direction of the data, and the trace count value.

The step of outputting the reserved resource information includes the steps of: confirming whether the TEID is stored by searching the tracing information DB; mapping the subscriber tracing information corresponding to the TEID and outputting the resource information to the operator when the resource information is stored in the TEID; increasing the track count value in the call tracing information DB and comparing the stored trace critical value; and deleting the TEID and the corresponding tracing information in the tracing

information DB when the trace count value is the same as the trace critical value.

If there is time information for maintaining corresponding tracing function in the tracing information, a step of operating a timer corresponding to the duration is further included when the TEID is received from the call tracing unit.

The call tracing unit cancels the tracing function of the corresponding subscriber message by deleting the TEID and the corresponding tracing information from the tracing information DB when the timer is terminated.

If the call for the subscriber is canceled, a step of canceling the set of the tracing function is further included. The step of canceling the tracing function includes the steps of: transmitting a session termination notice having identification information of the subscriber whose call is canceled at the call tracing unit to the call tracing unit; and canceling the subscriber message tracing information by deleting the corresponding TEID and the tracing information in the tracing information DB using the identification information at the tracing information DB.

It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as

claimed.

Referring to FIG. 5, the GTP-U tracing system according to an embodiment of the present invention is same as the conventional system. However, the call tracing unit (24) receives GTP-U tracing request which is a request for tracing of GTP-U reserved resource of a specified subscriber from the operator through MMI (30).

The GTP-U tracing request includes the tracing information. The tracing information includes information such as the IMSI or an IP address, a tracing type, a trace critical value, and further includes information of tracing function duration time.

IMSI is a subscriber identification number and IP is an address allotted to the corresponding subscriber to call through the internet. The tracing type refers to a method of performing a corresponding tracing. In a case of tracing the GTP-U, the SGSN (10) record-type bits are preferably set as in Table 1.

**[Table 2]**

Tracing type	Bit4	Bit3	Bit2	Bit1
GTP-U tracing	0	1	1	1

The critical value for tracing is a parameter for limiting the number of messages to be traced during GTP-U

tracing, and is divided into an up-stream critical value and a down-stream critical value according to a traffic direction of the message. The up-stream critical value is a maximum number of the tracing object messages trafficked from the SGSN (10) to the internet, and the down-stream critical value is a maximum number of the tracing object messages trafficked from the internet to the SGSN (10). The trace critical value ends tracing GTP-U in a corresponding direction when the number (counted value) of traced messages reaches the trace critical value.

The trace function duration time is a parameter to prevent the GTP-U from being excessively traced for the performance of the system, and more specifically corresponds to the duration of GTP-U tracing. Accordingly, if the trace function duration time is exceeded, the GTP-U tracing is ended when the number of the messages is under the trace critical value.

The call-tracing unit (24) of the present invention transmits the IMSI or the IP address or the trace critical value in the received tracing information to the GTP-U manager (26), so as to request the GTP-U tracing function registration. The call-tracing unit (24) also reports a response of the GTP-U tracing function registration to the MMI (30) when the tracing function is registered, and reports the GTP resource information to the operator through the MMI (30) by mapping

the GTP resource information, the IMSI or IP address of the tracing object subscriber when the GTP resource information, i.e., the result of the GTP-U tracing is received from the packet processor (22).

The TEID identifies a plurality of virtual tunnels allotted to each call between GTP layers of the SGSN (10) and the SGSN interface unit (21).

FIG. 6 shows a structure of the tracing information DB (25). The tracing information DB (25) stores a tracing information index (INDEX), an IMSI of the subscriber to be traced, a digit number of the IMSI (IMSI\_CNT), the IP address (IP\_ADDR), the tracing type (TRC\_TYPE), the TEID mapped to the IMSI or IP address received from the call manager (26), a trace count value (Up/Down Stream CNT), and the trace critical value (Up/Down Stream LMT) as well as a timer identifier (TIMER\_ID) operated during a corresponding duration when the trace function duration is received from the operator and the received trace function duration.

The tracing information DB (25) may include a separate DB for tracing a conventional GTP-C.

The call manager (26) sets a call of the subscriber by generating a tunnel networking with SGSN (10) when receiving GTP-C and performing call managing through the generated tunnel by mapping IMSI or IP address to arbitrarily TEID using a subscriber information table as shown in a table below.

[Table 3]

IMSI	IP address	TEID	Subscriber profile
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If GTP-U tracing function registration request including tracing information such as IMSI, IP address, or tracing critical value is received from the call-tracing unit (24), the call manager (26) registers GTP-U tracing function by transmitting the tracing information to a packet processor (22) by searching TEID mapped to the IMSI or IP address in the subscriber information table, and transmits the searched TEID to the call-tracing unit (24).

The packet processor (22) performs routing to the GTP-U received from the SGSN interface unit (21) using the TEID table so as to transmit the received GTP-U to the internet (not shown in the drawing) through the interface unit (23), or performs routing to the GTP-U received through the internet interface unit (23) so as to transmit the received GTP-U to the SGSN (10) through the SGSN interface unit (21).

[Table 4]

TEID	IP address	QoS	Stream band (Up/Down)	Tracing flag	Trace critical value	Trace count value
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Further, when TEID and tracing information is received



from the call manager (26) in connection with the GTP-U tracing function registration, the packet processor (22) stores the tracing information (tracing critical value) to the corresponding field of the TEID table and activates a tracing flag.

When the GTP-U with the TEID is detected, the packet processor (22) also transmits the GTP resource information as much as the trace critical value to the call-tracing unit (24) while increasing tracing count value. In this instance, when the trace count value is the same as the tracing critical value, the packet processor (22) inactivates the tracing flag and removes the corresponding CTP-U tracing function by deleting the trace count value and the trace critical value.

The GTP resource information preferably includes information as shown in Table 5.

**[Table 5]**

Field	Contents
CNT	Count reported to call tracing unit for UP/DOWN Stream
STREAM DIR	Stream direction
AMA No	AMA number (ATM Management Assemble) of SGSN interface unit / Internet interface unit
INF No	Interface number of SGSN interface unit / Internet interface unit

PORT No	Port number of SGSN interface unit / Internet interface unit
VPI/VCI	VPI/VCI number of SGSN interface unit / Internet interface unit
LINK BW	UP/DOWN Stream link band of SGSN interface unit / Internet interface unit

FIG. 7 illustrates a flow chart describing a GTP-U tracing operation according to the present invention.

Referring to FIG. 7, the call-tracing unit (24) receives GTP-U tracing request signal including in the tracing information of the subscriber to be traced from the operator through the MMI (30) (S610) and sets the STP-U tracing function of the corresponding subscriber (S620).

In other words, the call-tracing unit (24) transmits the IMSI or IP address and the trace critical value in the tracing information so as to request the GTP-U tracing function registration, and the call manager (26) searches TEID mapped in IMSI or IP address received from the call tracing unit (24) in the subscriber information table like the Table 3, registers the GTP-U tracing function to the corresponding TEID by transmitting the searched TEID and the tracing critical value, and transmits the searched TEID to the call tracing unit (24).

Then, the call tracing unit (24) sets the GTP-U tracing

function by storing the tracing information received from the operator and the TEID received from the call manager (26) into the tracing information DB (25).

Meanwhile, the packet processor (22) traces GTP-U trafficked through the SGSN interface unit (21) and the internet interface unit (23), and transmits the GTP resource information reserved by the corresponding GTP-U message to the call tracing unit (24) when the GTP-U to be traced is detected (S640). The call tracing unit (24) then reports the received GTP resource information to the operator through the MMI (30) (S660).

FIG. 8 is a flow chart showing an operation of a call tracing unit (24) for setting the GTP-U tracing function. Referring to FIG. 8, the call tracing unit (24) receives the GTP-U tracing request message from the operator through the MMI (30) (S610). The GTP-U tracing request message includes the IMSI or IP address, i.e., the tracing information for the subscriber to be traced, the trace critical value, and the trace function duration for limiting the corresponding tracing time.

The call-tracing unit (24) stores the IMSI or IP address in the GTP-U tracing function registration request message and transmits the tracing information to the call manager (26) so as to request the GTP-U tracing function registration (S621). In this case, the call tracing unit (24)

sets time-out as long as a time of IMR1 for detecting whether a response message is received from the call manager (26) within a predetermined time.

Upon receiving the GTP-U tracing function registration response message corresponding to GTP-U tracing function registration request from the call manager (26) (S622), the call tracing unit (24) searches the result value stored in the response message, and operates a timer corresponding to the trace function duration contained in the tracing information from the operator (S623, S624) if the registration value is the registration success (the GTP-U tracing flag is activated).

In other words, when the GTP-U tracing function registration is succeeded, a timer termination signal storing the TEID received from the call manager (26) together with the trace function duration is registered into an OS such that the timer termination signal reporting a termination of the trace function duration can be received. In this instance, when the registration of the timer termination signal fails, the call tracing unit (24) reports to the operator that setting the GTP-U tracing function is failed.

Setting the GTP-U tracing function according to the GTP-U tracing request of the operator is finished (S625) by storing the received tracing information from the operator and the TEID contained in GTP-U tracing registration response message received from the call manager (26).

Meanwhile, when there is no response message for the GTP-U tracing function registration request from the call manager (26) (S622), or the result value of the response message for the corresponding GTP-U tracing function registration request is a value (FAIL) indicating the failure of the registration (S623), the failure of setting the GTP-U tracing function is reported to the operator (S626).

FIG. 9 is a flow chart showing an operation of a call manager (26) for setting STP-U tracing function. Referring to FIG. 9, the call manager (26) receives the GTP-U tracing function registration request message from the call tracing unit (24) (S631) and confirms whether the call for the corresponding subscriber exists by decoding the IMSI or IP address from the tracing information contained in the corresponding message (S632, S633).

As a result of the above confirmation, in case there is a corresponding call, the call manager (26) searches the TEID mapped to the IMSI or IP address by searching the subscriber information table like the Table 3 (S634), and registers GTP-U tracing function by transmitting the searched TEID together with the tracing information (trace critical value) to the packet processor (22) (S635). And then, the call manager (26) sets the result value (SUCCESS) indicating a success of the registration to the GTP-U tracing function registration response message and transmits the GTP-U tracing function

registration response message together with the TEID to the call-tracing unit (24) (S636).

As a result of the confirmation whether the call for the subscriber at the step exists (S633), when the call does not exist, the call manager (26) sets the result value (FAIL) indicating a registration failure to the GTP-U tracing function registration response message and transmits the GTP-I tracing function registration message to the call tracing unit (24) (S637).

FIG. 10 is a flow chart showing GTP-U tracing operation of a packet processor (22). Referring to FIG. 10, the packet processor (22) stores the received tracing information in a trace critical value field corresponding to the received TEID in the TEID table as in Table 4 and activates the corresponding tracing flag (S642) when the TEID related to the GTP-U tracing function registration and the tracing information (trace critical value) are received from the call manager (26).

The packet processor (22) receives the GTP-U trafficked through the SGSN (10) interface unit (21) or the internet interface unit (23), and confirms the TEID of the corresponding message and the packet processor (22) confirms whether the tracing flag for the corresponding TEID is activated by searching the confirmed TEID in the TEID table with a search key (S633, 634).

As a result of aforementioned confirmation, when the tracing flag is activated, the GTP resource information as in FIG. 5 and the TEID are stored on the GTP resource information message. The GTP resource information message is transmitted to the call tracing unit (24) (S645, S646).

The packet processor (22) increases the corresponding trace count value of the TEID Table by 1 (S647), compares the trace count value with the corresponding trace critical value (S648), performs a next GTP-U detection when the trace count value is not the same with the corresponding trace critical value (S644), or deletes the trace count value and the trace critical value and terminates the GTP-U tracing movement by inactivating the tracing flag (S649) when the trace count value is the same as the corresponding trace critical value.

In this instance, comparison of the trace count value and the trace critical value is separately carried out for each of the up stream and down stream. Therefore, the GTP-U tracing movement of the corresponding stream is terminated when the trace count value of one of the up/down streams is the same as the trace critical value.

FIG. 11 is a flow chart for outputting GTP resource information of a call tracing unit (24). Referring to FIG. 11, for a period of time when the timer corresponding to the tracing function duration is not terminated (S661), the call tracing unit (24) searches whether the corresponding TEID

included in the GTP resource information message received from the packet processor (22) is stored on the tracing information DB (25) by using the search key (S662, S663).

As a result of the search, the call tracing unit (24) aborts the received GTP resource information message when the TEID is not stored on the tracing information DB (25), and outputs the IMSI or IP address mapped to the TEID together with the GTP resource information contained in the GTP resource information message to the operator through the MMI 30) when the TEID is stored on the tracing information DB (25) (S664).

In this instance, the GTP resource information includes the trace count value stored in the TEID table of the packet processor (22), and the trace count value is the same value as the trace count value stored in the tracing information DB (25). However, when the trace count values are different from each other by the inconsistency of the packet processor (22) and the call tracing unit (24), the GTP resource information has the trace count value stored on the tracing information DB (25).

The call-tracing unit (24) which output the GTP resource information increases the corresponding trace count value of the tracing information DB (25) by 1, compares to the next trace critical value (S665, S666), cancels the timer by using the timer ID stored on the tracing information DB (25)



when the tracing count value and the trace critical value are the same (S667), and terminates the corresponding GTP-U tracing by deleting the data related to the corresponding TEID in the tracing information DB (25), i.e., the tracing information and the trace count value (S668).

In this instance, comparison of the trace count value and the trace critical value is separately carried out for each of the up/down streams. Therefore, the GTP-U tracing movement of the corresponding stream is terminated when one of the trace count values of the up stream and the down stream is the same as the trace critical value.

Meanwhile, when the time corresponding to the tracing function duration is terminated, i.e., the timer termination signal registered in OS is received (S661), the call-tracing unit (24) searches the tracing information DB (25) by using the TEID contained in the timer termination signal as the search key, and detects all the corresponding data related to TEID so as to terminate the corresponding GTP-U tracing movement (S668). In this case, the timer termination signal is aborted when the TEID does not exist in the tracing information DB (25).

In the meantime, when the call of the subscriber to be traced is canceled, the call tracing unit (24) receives a session termination notifying message from the call manager (26), searches the tracing information DB (25) by using the

IMSI or IP address contained in the session termination notifying message and the TEID as the search key, deletes all the related data such as the tracing information and the trace count value corresponding to the corresponding TEID, and terminates the corresponding GTP-U tracing movement.

When the operator requests to cancel the GTP-U tracing function for a particular subscriber whose GTP-U tracing function was set already, where the request is set in the GTP-U tracing function from the operator, the GTP-U tracing function is canceled through the same abovementioned GTP-U tracing function setting.

FIG. 12 is a flow diagram for tracing GTP-U according to an embodiment of the present invention.

Referring to FIG. 12, the call tracing unit (24) receives the GTP-U tracing request message including the tracing information for the subscriber to be traced from the operator through the MMI (30) (S1) and transmits the GTP-U tracing function registration request message containing the tracing information to the call manager (26) (S2).

The call manager (26) searches TEID mapped to the IMSI or IS address from the tracing information and stores the information in the GTP-U tracing function registration request message together with the tracing information, and transmits to the packet processor (22) (S3).

Then, the packet processor (22) stores the tracing

information in the inner TEID table and registers the GTP-U tracing function by activating a tracing flag for the received TEID (S4), and transmits the GTP-U tracing function registration response message to the call manager (26) (S5).

The call manager (26) received the replay message transmits the GTP-U tracing function registration response message including the searched TEID to the call tracing unit (24) (S6). The call tracing unit (24) sets the GTP-U tracing function for the corresponding subscriber by storing TEID included in the response message and the tracing information inputted from the operator to the tracing information DB (25) (S7).

Then, when detecting GTP-U having registered TEID (S8), the packet processor (22) transmits the resource information of the corresponding message and the GTP resource information message having the corresponding TEID to the call tracing unit (24). The call tracing unit (24) searches the IMSI or IP address mapped in the TEID received from the tracing information DB (25), stores the searched IMSI or IP address and the GTP resource information onto GTP-U tracing result message, and reports to the operator through the MMI (30) (S10).

Meanwhile, the call tracing unit (26) transmits the session termination message to the call tracing unit (24) when the call of the subscriber to be traced is canceled (S12). The

call tracing unit (24) cancels the tracing function for the corresponding subscriber by deleting the related data in the tracing information DB (25) using the IMSI, IP address or TEID contained in the corresponding message and reports it (S13).

Then, if the GTP-U tracing cancel request message containing the tracing cancel subscriber from the operator through MMI (30) (S14), the call tracing unit (24) transmits the GTP-U tracing function cancel request message having the subscriber information to the call manager (26) (S15).

The call manager (26) searches TEID mapped to the IMSI or IP address contained in the subscriber information, stores the searched TEID in the GTP-U tracing function cancel request message, and transmits to the packet processor (22) (S16).

Then, the packet processor (22) inactivates the tracing flag of the corresponding TEID in the inner TEID table and cancels the GTP-U tracing function (S17), and transmits GTP-U tracing function cancel response message to the call manager (26) (S18).

The call manager (26) received the response message transmits the GTP-U tracing function cancel response message containing the TEID to the call tracing unit (24) (S19). The call tracing unit (24) deletes all the related data in the tracing information DB (25) by using the TEID contained in the response message so as to terminate the GTP-U tracing function for the corresponding subscriber (S20).

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

#### **[EFFECT OF THE INVENTION]**

As has been described, the present invention traces the GTP-U of a subscriber using the TEID of the subscriber to be traced, to provide an improved understanding of the GTP resource allotted to a corresponding GTP-U message that is the data of the subscriber.

Further, the present invention effectively manages packet troubles generated from the SGSN and the attack of such EEOS through the GTP-U on Internet by isolating only the interface generating the corresponding attack.

Further, the present invention may prevent declining of conducting capacity on a system by discontinuing the GTP-U tracing automatically through tracing function duration time and tracing critical value.

**What is claimed is :**

1. A method for tracing GTP resource including the steps of:

setting the tracing function for reserved resources of the subscriber message by using the TEID of the subscriber to be traced; and

outputting information for the corresponding resource by detecting the subscriber message with a set of the tracing function.

2. A method for tracing GTP resource as claimed in claim 1, wherein the step of setting the tracing function includes the steps of:

transmitting the user tracing information received from the operator in the call tracing unit to the call manager;

searching TEID allotted to the user using the tracing information in the call manager;

registering the user message tracing function to the packet processor and transmitting the TEID to the call tracing unit; and

storing the TEID together with the tracing information in the tracing information DB.

3. A method for tracing GTP resource as claimed in claim 2, wherein the tracing information includes the IMSI and

IP address of the subscriber, a tracing type for commanding the subscriber message tracing, and a trace critical value, i.e., a maximum number of the message of the subscriber to be traced.

4. A method for tracing GTP resource as claimed in claim 2, wherein the tracing information, TEID and the trace count value that is the number of traced message are stored in the tracing information DB.

5. A method for tracing GTP resource as claimed in claim 2, wherein the TEID registering step includes the steps of:

receiving the TEID and the tracing information in the packet processor; and

activating the tracing flag of the corresponding TEID field in an inner TEID table and storing the tracing information.

6. A method for tracing GTP resource as claimed in claim 1, wherein the step of outputting the reserved resource information includes the steps of:

confirming the TEID of the trafficked subscriber message in the packet processor;

confirming whether the tracing flag of the confirmed

TEID is activated by searching the TEID table;

transmitting the reserved resource information of the subscriber together with the TEID to the call tracing unit when the tracing flag is activated; and

outputting the reserved resource information to the operator by using the TEID from the call tracing unit.

7. A method for tracing GTP resource as claimed in claim 6, wherein the reserved resource information includes an AMA number of trafficked subscriber message, an interface number, a VPI/VCI, a link band, a value directing a stream direction of the data, and the trace count value.

8. A method for tracing GTP resource as claimed in claim 6, wherein the step of outputting the reserved resource information includes the steps of:

confirming whether the TEID is stored by searching the tracing information DB;

mapping the subscriber tracing information corresponding to the TEID and outputting the resource information to the operator when the resource information is stored in the TEID;

increasing the track count value in the call tracing information DB and comparing the stored trace critical value; and



deleting the TEID and the corresponding tracing information in the tracing information DB when the trace count value is the same as the trace critical value.

9. A method for tracing GTP resource as claimed in claim 2, wherein if there is time information for maintaining corresponding tracing function in the tracing information, a step of operating a timer corresponding to the duration is further included when the TEID is received from the call tracing unit.

10. A method for tracing GTP resource as claimed in claim 9, wherein the call tracing unit cancels the tracing function of the corresponding subscriber message by deleting the TEID and the corresponding tracing information from the tracing information DB when the timer is terminated.

11. A method for tracing GTP resource as claimed in claim 1, wherein if the call for the subscriber is canceled, a step of canceling the set of the tracing function is further included.

12. A method for tracing GTP resource as claimed in claim 11, wherein the step of canceling the tracing function includes the steps of: transmitting a session termination

notice having identification information of the subscriber whose call is canceled at the call tracing unit to the call tracing unit; and canceling the subscriber message tracing information by deleting the corresponding TEID and the tracing information in the tracing information DB using the identification information at the tracing information DB.

**[Drawing]**FIG. 1

21 : SGSN Interface Unit  
 22 : Packet Processor  
 23 : Internet Interface Unit  
 24 : Call Tracing Unit  
 26 : Call Manager  
 25 : Tracing Information DB

FIG. 2

Attribute	Meaning
INDEX	Tracing Information Index
IMSI	Number of subscriber to be traced
IMSI_CNT	Digit Number of subscriber
IP_ADDR	IP Address of subscriber to be traced
TRC_TYPE	Current Tracing Type

FIG. 3

Start

S301 : Receive GTP-C tracing request

S302 : Store subscriber information to be traced into

tracing information DB

S303 : In Storing succeed?

Yes / No

S304 : Output success message of setting tracing  
function

S305 : Output failure message of setting tracing  
function

End

FIG. 4

Start

S401 : Receive GTP-C message

S402 : Search tracing information DB

Set tracing function?

Yes / No

S404 : Tracing type = Call tracing?

S405 : Transmit GTP-C message to call tracing unit

S406 : Transmit call end time and location information  
when call-canceling

S407 : Report call processing situation to operator in  
call tracing unit

S408 : Report information received from call tracing  
unit to operator

End

FIG. 5

(FIG. 1 과 거의 흡사)

GTP resource information

FIG. 6

(FIG. 2 에서 추가된 부분만 번역하였음)

TEID	Tunnel Identifier
DURATION	Tracing function Duration
Up/Down stream LMT	Trace Critical Value
Up/Down stream CNT	Trace Count Value
TIMER_ID	Timer Identifier

FIG. 7

Start

S610 : Receive GTP-U tracing request

S620 : Set tracing function to TEID of GTP-U message  
for subscriber to be traced

S640 : Detect GTP-U message with registered TEID

S660 : Output resource information of detected GTP-U  
message

End

FIG. 8

Start

S610 : Receive the GTP-U tracing request

S621 : Request registration of GTP-U tracing function  
by transmitting tracing information to call tracing unit

S622 : Is GTP-U tracing function registration response  
message received?

S623 : Is registration succeed?

S624 : Operate timer

S625 : Store tracing information and TEID

S626 : Report failure of setting GTP-U tracing function  
to operator

End

FIG. 9

Start

S631 : Receive GTP-U tracing function registration

S632 : Confirm IMSI or IP address in tracing  
information

S633 : Does corresponding call currently exist?

S634 : Search TEID mapped IMSI or IP address

S635 : Transmit searched TEID and tracing information  
to packet processor and register GTP-U tracing function

S636 : Transmit GTP-U tracing function registration

response for notifying success of registration to call-tracing unit

S637 : Transmit reply to GTP-U tracing function registration for notifying failure of registration to call tracing unit

FIG. 10

S641 : Receive TEID and tracing information

S642 : Store tracing information in corresponding field of TEID table and activate tracing flag

S643 : Receive GTP-U message

S644 : Search TEID table with TEID of GTP-U message as search key

S645 : Is tracing flag of corresponding TEID activated?

S646 : Transmit GTP tracing information to call tracing unit

S647 : Increase corresponding count value of TEID table

S648 : Trace count value = Trace critical value

S649 : Delete trace count value, trace critical value and trace critical value of TEID table and inactive tracing flad

End

FIG. 11

Start

S661 : Terminate timer

S662 : Receive GTP tracing information and TEID from  
packet processor

S663 : Search tracing information DB with TEID as  
search key

S664 : Output GTP resource information together with  
IMSI or IP to operator

S665 : Increase corresponding trace count value of  
tracing information DB

S666 : Trace count value = Trace critical value?

S667 : Cancel Timer

S668 : Delete TEID related data from tracing  
information DB

End

FIG. 12

호추적부 : call tracing unit

호처리부 : call manager

패킷처리부 : packet processor

GTP-P tracing request

Set GTP-U tracing function

Report GTP-U tracing result

Report session termination



GTP-U tracing cancellation request

GTP-U tracing function termination

GTP-U tracing function registration request

GTP-U tracing function registration replay

Session termination notification

GTP-U tracing function cancellation request

GTP-U tracing function cancellation replay

GTP resource information

Detect call cancellation

GTP-U tracing function registration

GTP-U message detection

GTP-U tracing function cancellation



## DRAWINGS

FIG1

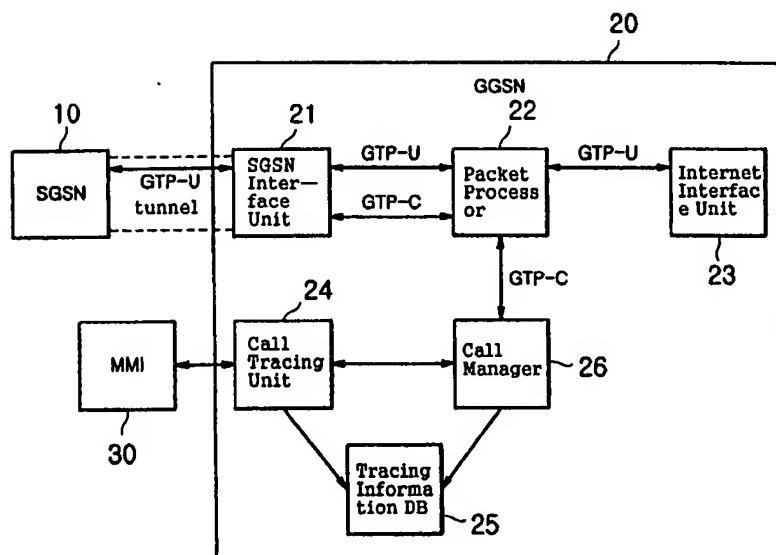


FIG 2

Attribute	Meaning
INDEX	Tracing Information Index
IMSI	Number of subscriber to be traced
IMSLCNT	Digital Number of subscriber
IP_ADDR	IP Address of subscriber to be traced
TRC_TYPE	Current Tracing Type

FIG 3

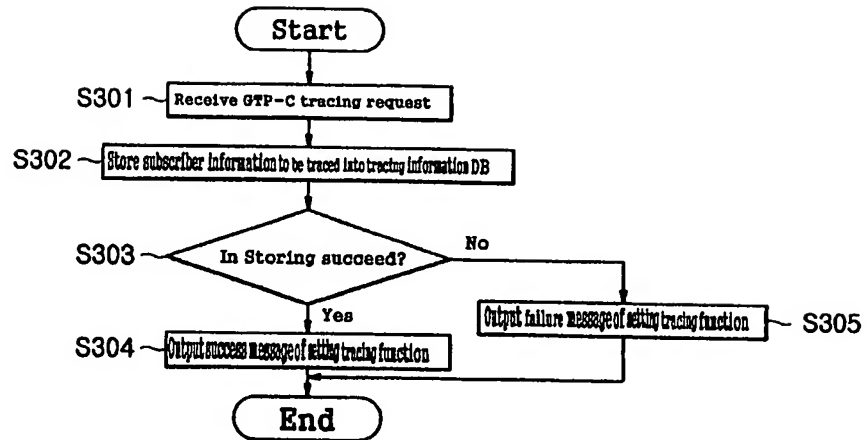


FIG 4

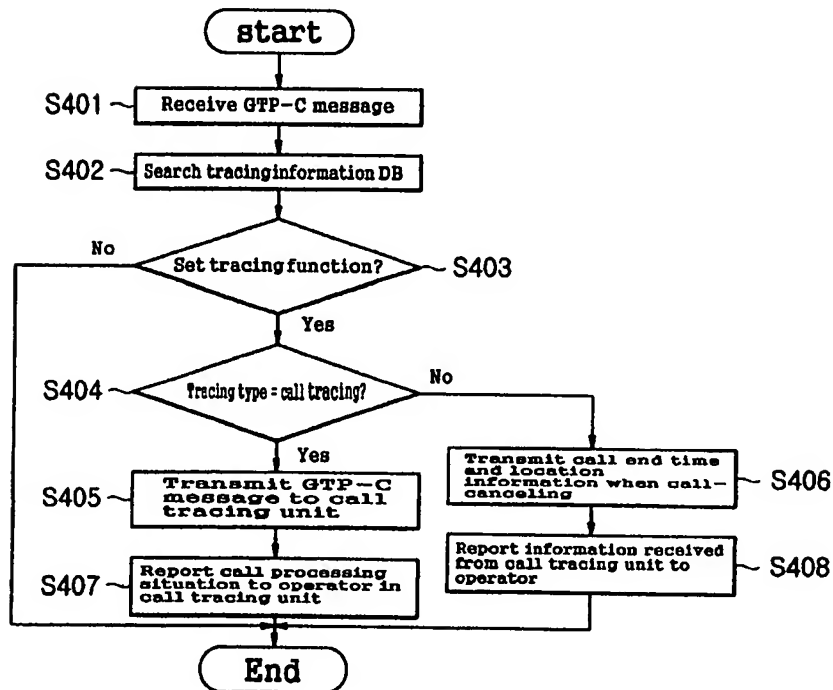


FIG 5

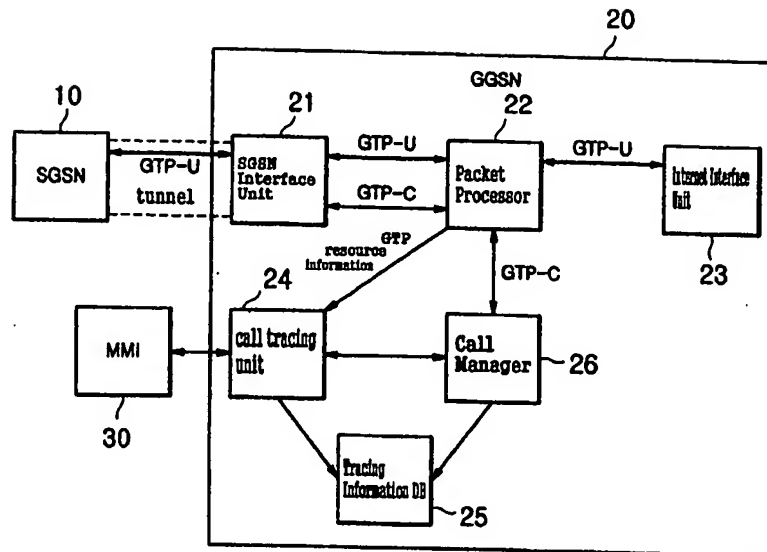


FIG 6

Attribute	Meaning
INDEX	Tracing Information Index
IMSI	Number of subscriber to be traced
IMSLCNT	Digital Number of subscriber
IP_ADDR	IP Address of subscriber to be traced
TRC_TYPE	Current Tracing Type
TEID	Tunnel Identifier
DURATION	Tracing function Duration
Up/Down stream LMT	Tracing Critical Value
Up/Down stream CNT	Tracing Count Value
TIMER_ID	Timer Identifier

FIG 7

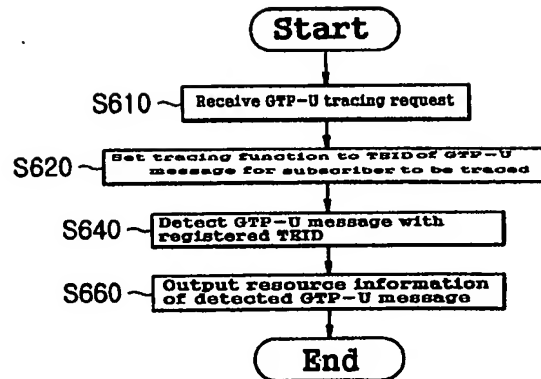


FIG 8

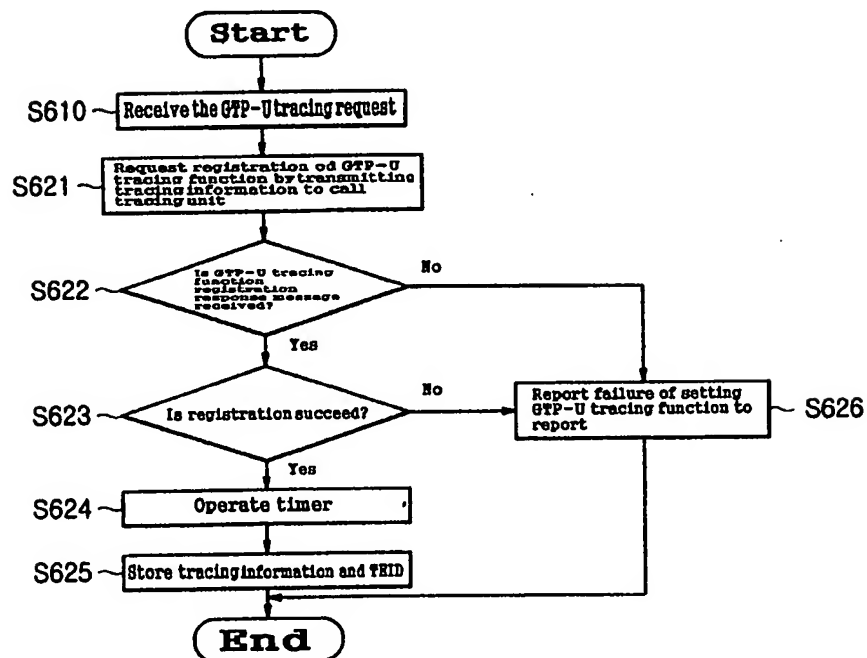


FIG 9

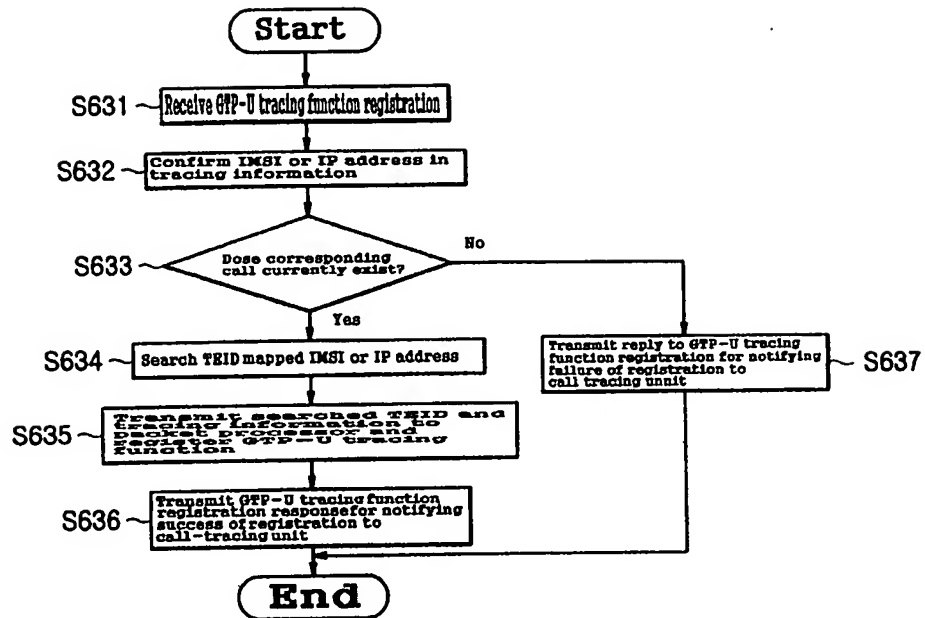


FIG 10

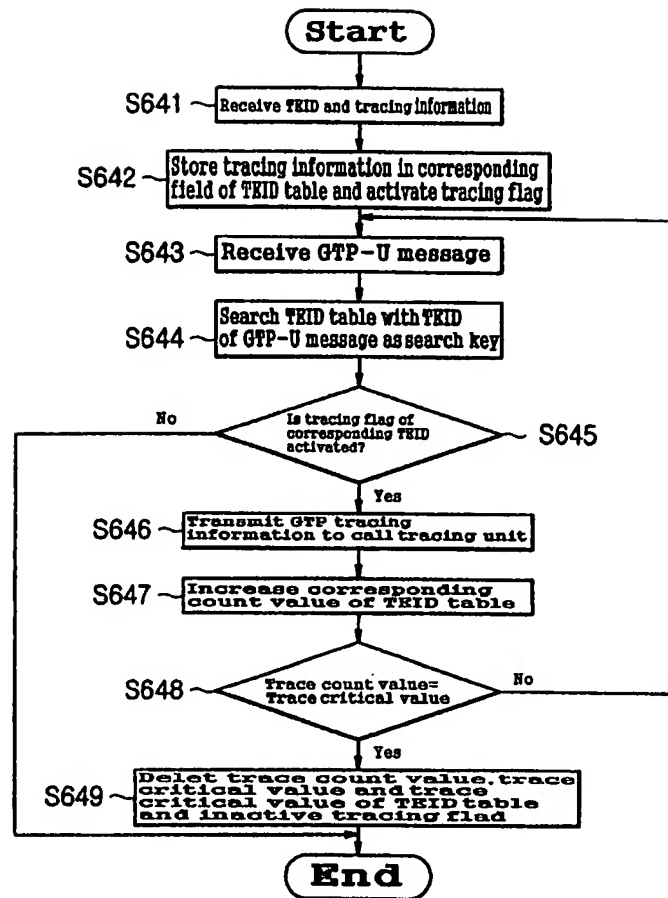


FIG 11

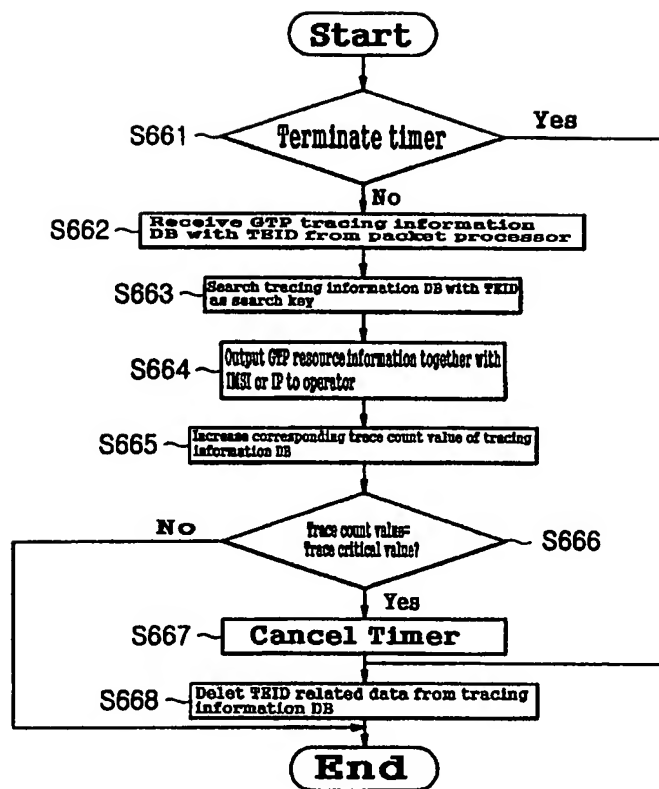




FIG 12

